# Construction of CRRES/MEA flux maps

After a lot of trial and error, I think I've finally managed to construct an algorithm to clean up the CRRES/MEA ephemeris. The pitch angles in several files are corrupted, in different ways:

- series of constant pitch angle (example: orbit 650)
- series of slowly decreasing pitch angle (example: orbit 792)
- pitch angles that deviate from the surrounding values (example: orbit 650)
- orbits or parts of orbits with wildly fluctuating pitch angles (example: orbit 831)

In addition, for a few orbits time runs backwards for a while, or even stops.

I now have an IDL programme that is able to detect these anomalies and identify the bad points. Some files are completely corrupted, and have been discarded, so that 1000 (this can't be a coincidence) files are left out of 1062. In the remaining files, on average about 1500 points are rejected out of 65,000, except for contaminated files where half or more can be rejected. Here are the log files of the IDL runs (a mere 165 hours of processing time, 130 of which are CPU) per CD:

1. CD 1: orbits 6-100 (orbits 1-5 are missing)
2. CD 2: orbits 101-198
3. CD 3: orbits 199-290
4. CD 4: orbits 291-442
5. CD 5: orbits 443-539 (orbits 366-415 are missing)
6. CD 6: orbits 540-634
7. CD 7: orbits 635-740
8. CD 8: orbits 741-834
9. CD 9: orbits 835-925
10. CD 10: orbits 926-1013
11. CD 11: orbits 1014-1067

For each orbit the following is printed: 1001 (flag indicating the file has been preprocessed), the orbit number, year, and day. This is followed by the log of the IDL session for that orbit, which ends with a line containing:

1. orbit number
2. number or points rejected because of deviating pitch angles (defined as deviating more than 2 degrees from a parabolic fit to the point in question plus two preceding and two succeding); this test is not applied when the five points are not consecutive in time
3. number or points rejected because pitch angle is equal to preceding pitch angle
4. number or points rejected at the edges of data gaps longer than 10 seconds
5. number or points rejected because time receeds or stops
6. number or points remaining

These checks are performed independently, so some points can be rejected by more than one criterion.

CRRES/MEA Fluxes (orbits 6-50 have not been used) have been binned in the same grid as the CRRESELE model: (E,L,B/B0,Ap15), but with the full range of L covered by CRRES. The links in the list below point to animated GIFs, showing the variation in Ap15. I'm not sure how far fluxes below 2.5 Re can be trusted. The measurement distribution is shown here. The evolution of Ap15 over the CRRES mission is shown here.

## CRRES/MEA Flux maps

Fluxes have been derived from count rates using the background channel correction and the nominal geometric factors given in the documentation on the CDs.

The maps show the flux distribution in the (L,B/B0) plane for the seventeen channels. I'm not sure how far fluxes below 2.5 Re can be trusted. Notice the filling of the slot region, and the shift to lower L of the region of maximum flux with increasing Ap15.

1. Channel 1
2. Channel 2
3. Channel 3
4. Channel 4
5. Channel 5
6. Channel 6
7. Channel 7
8. Channel 8
9. Channel 9
10. Channel 10
11. Channel 11
12. Channel 12

13. Channel 13
14. Channel 14
15. Channel 15
16. Channel 16
17. Channel 17

## CRRESELE Flux maps

The maps below show the CRRESELE flux divided by 4*pi* for the same maps as above. MEA Channels 1-6 are not covered by HEEF and are thus not shown.

1. Channel 7
2. Channel 8
3. Channel 9
4. Channel 10
5. Channel 11
6. Channel 12
7. Channel 13
8. Channel 14
9. Channel 15
10. Channel 16
11. Channel 17

## CRRES/MEA Coefficient of variation maps

The maps below show the CRRES/MEA coefficient of variation (standard deviation divided by average flux) for the same maps as above.

1. Channel 1
2. Channel 2
3. Channel 3
4. Channel 4
5. Channel 5
6. Channel 6
7. Channel 7
8. Channel 8
9. Channel 9
10. Channel 10
11. Channel 11
12. Channel 12
13. Channel 13
14. Channel 14
15. Channel 15
16. Channel 16
17. Channel 17

## (L,E) Maps

Finally, I produced equatorial (L,E) maps for CRRES/MEA and CRRESELE.

## Usage

I propose to replace the CRRES/MEA model maps produced by MSSL by the new maps and to make them available in SPENVIS. The animated GIFs can be used for presentations or illustrations.

I don't have time now to continue working on this, but I could refine the binning by doing a second averaging while rejecting fluxes that deviate more than two standard deviations from the bin average. The standard deviations could also be used for confidence levels, more or less like Vette did for AE-4 and AE-8.

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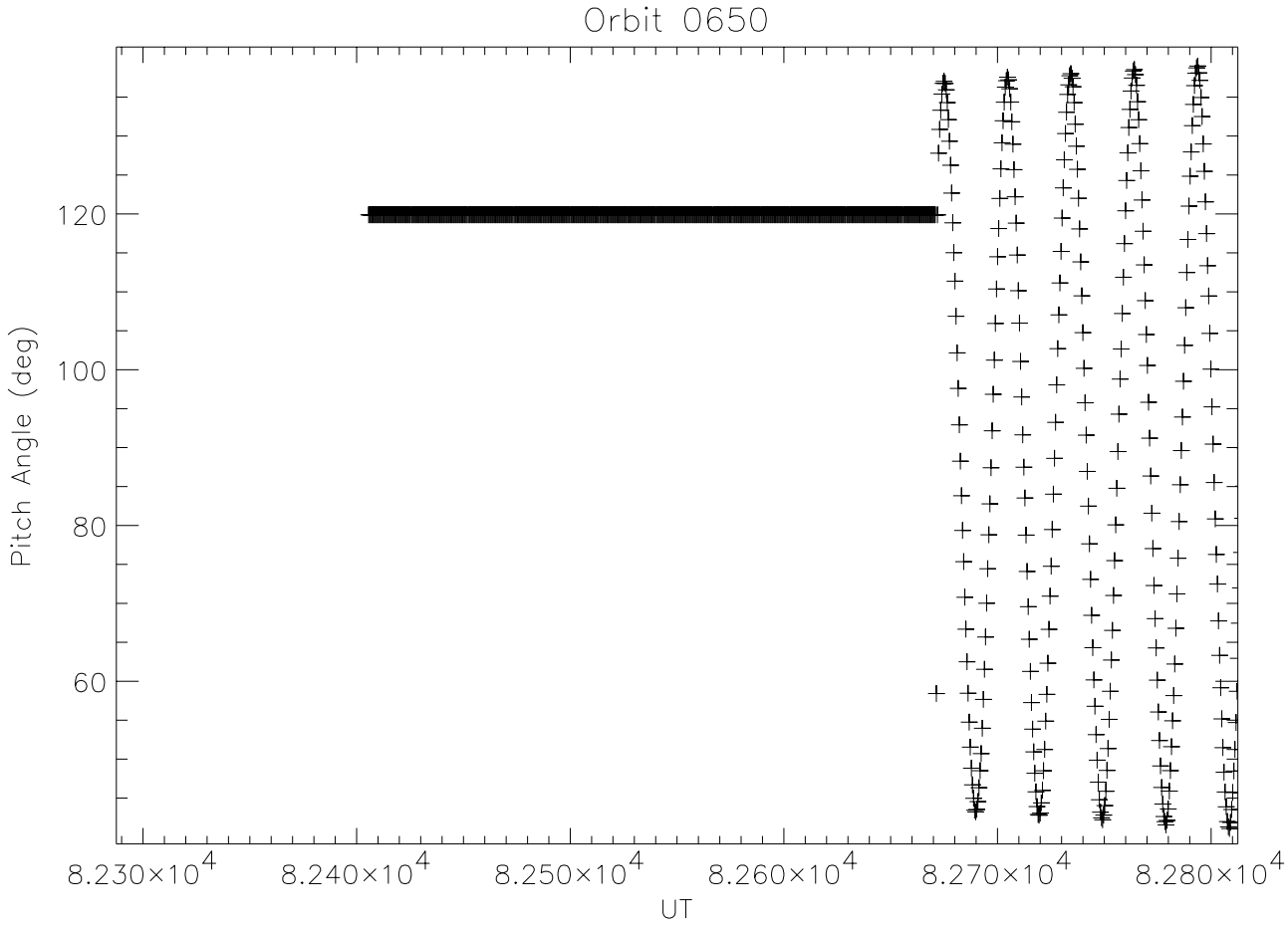
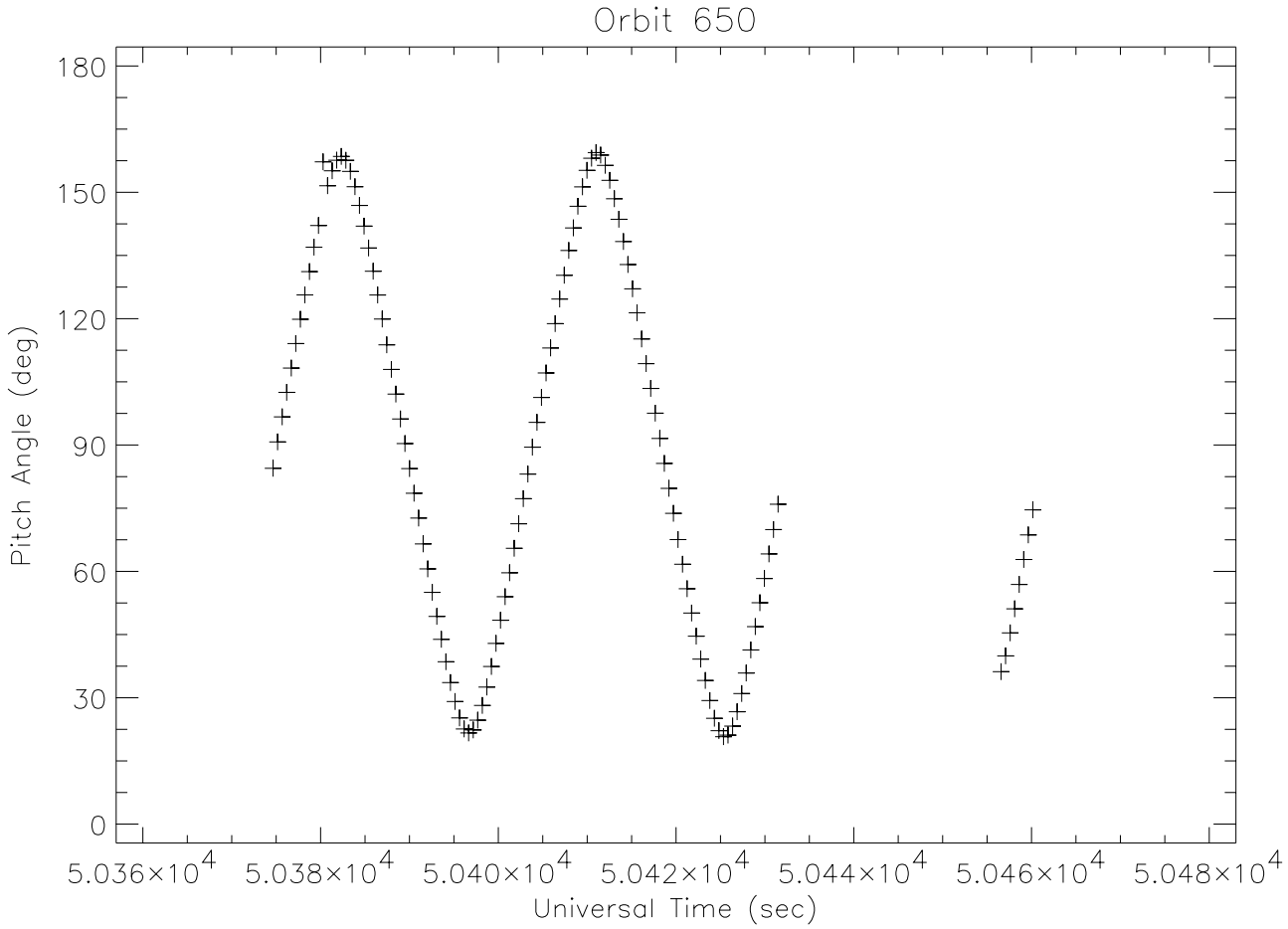
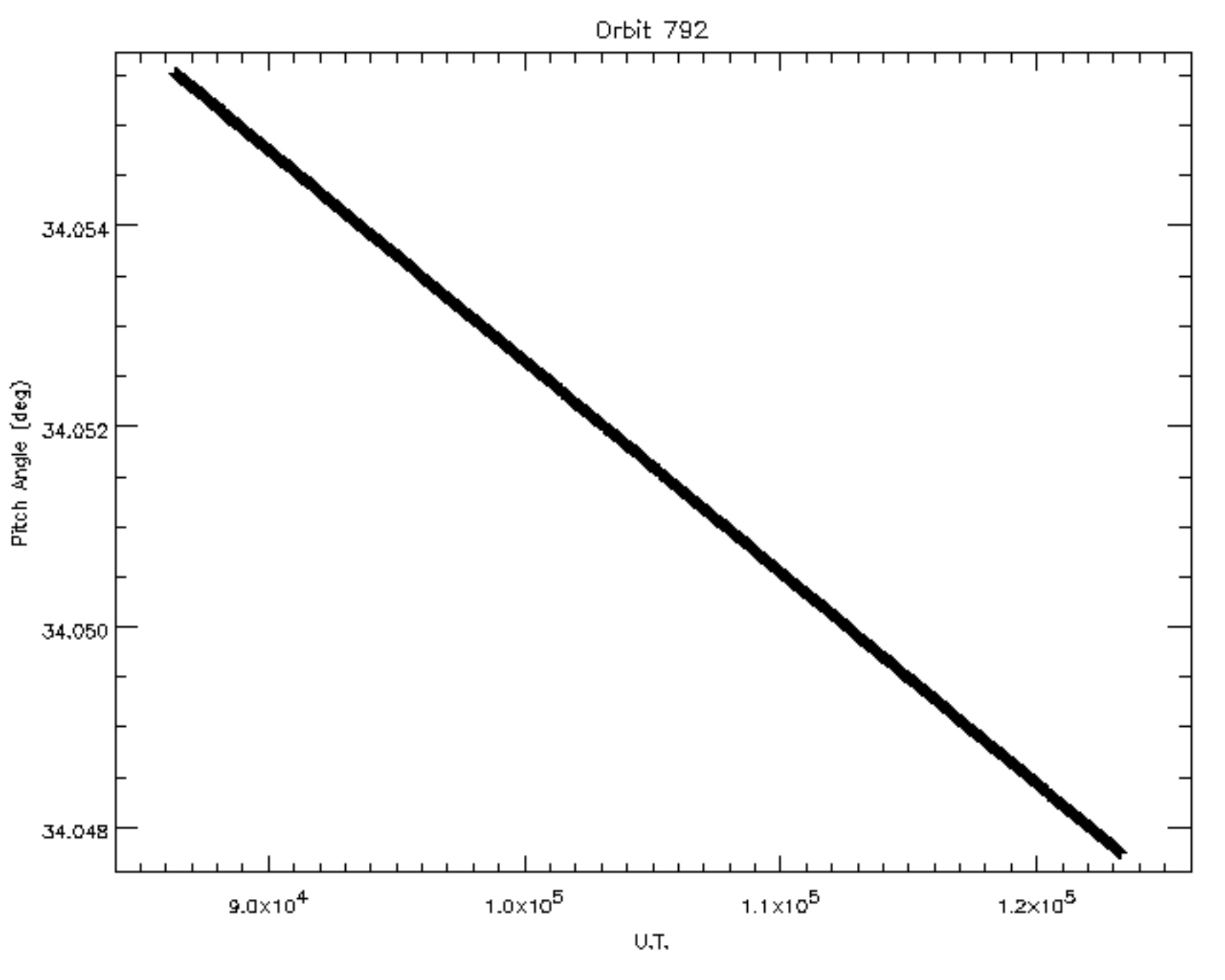
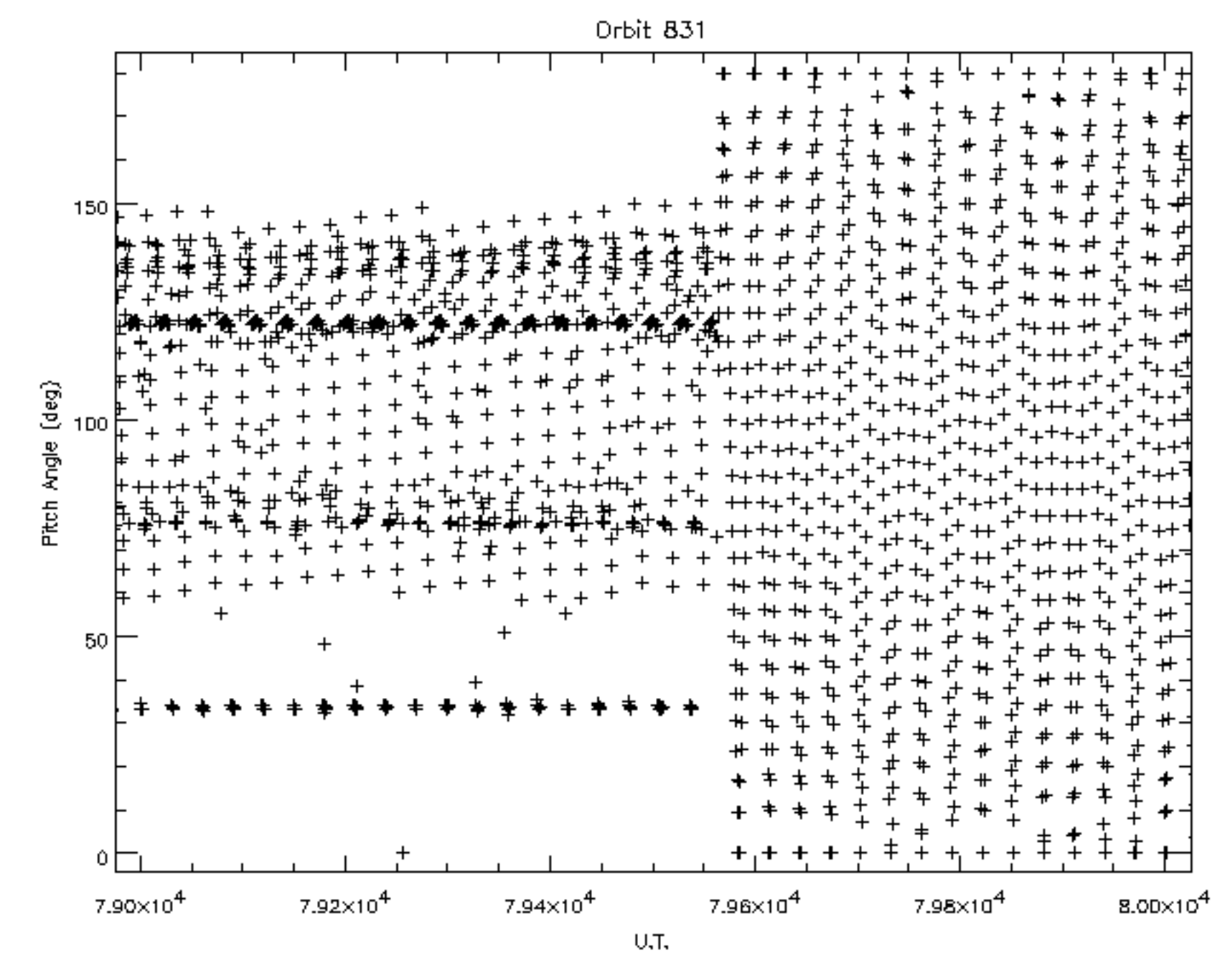
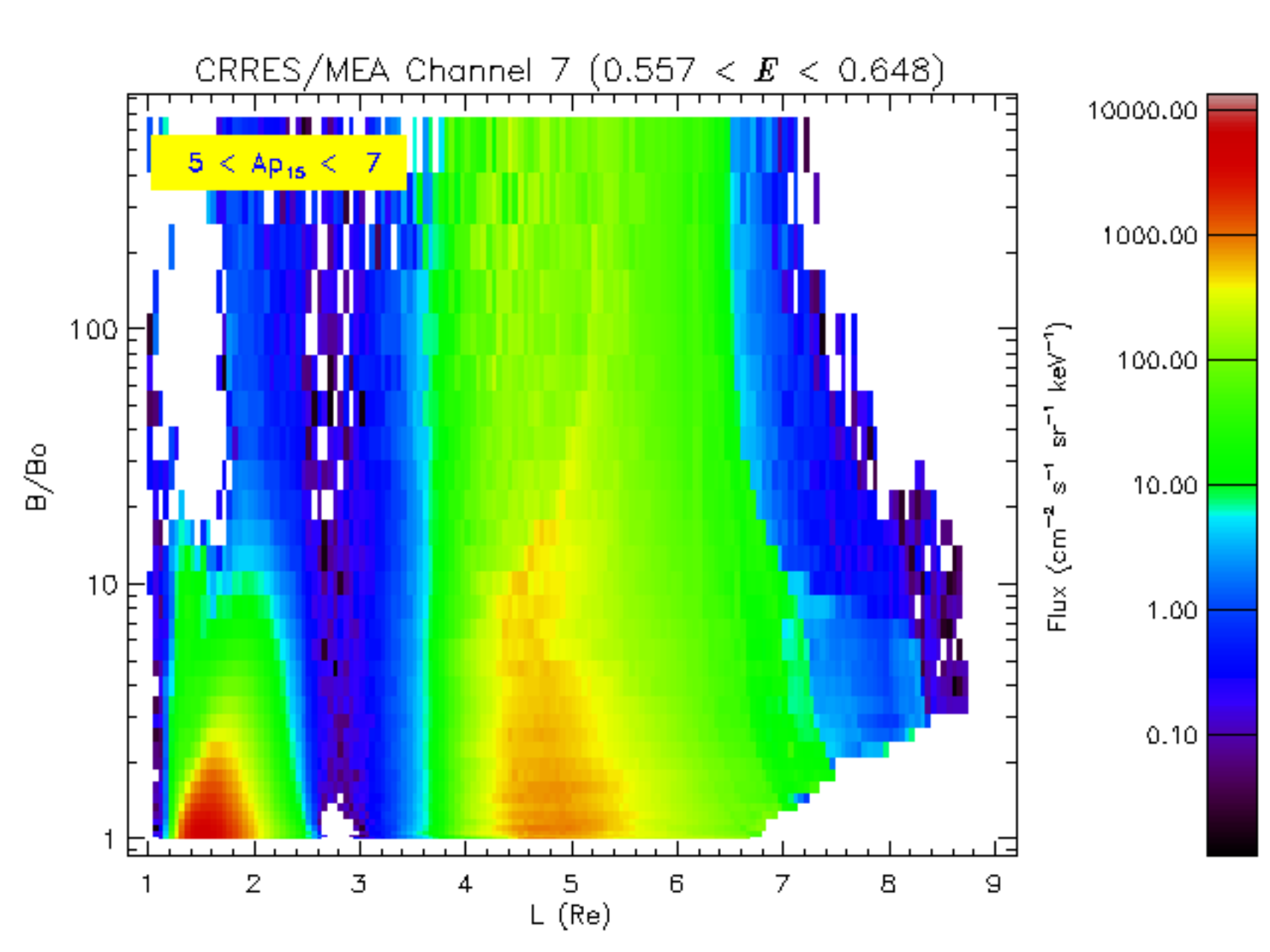
*Last update: 19 Oct 1999*

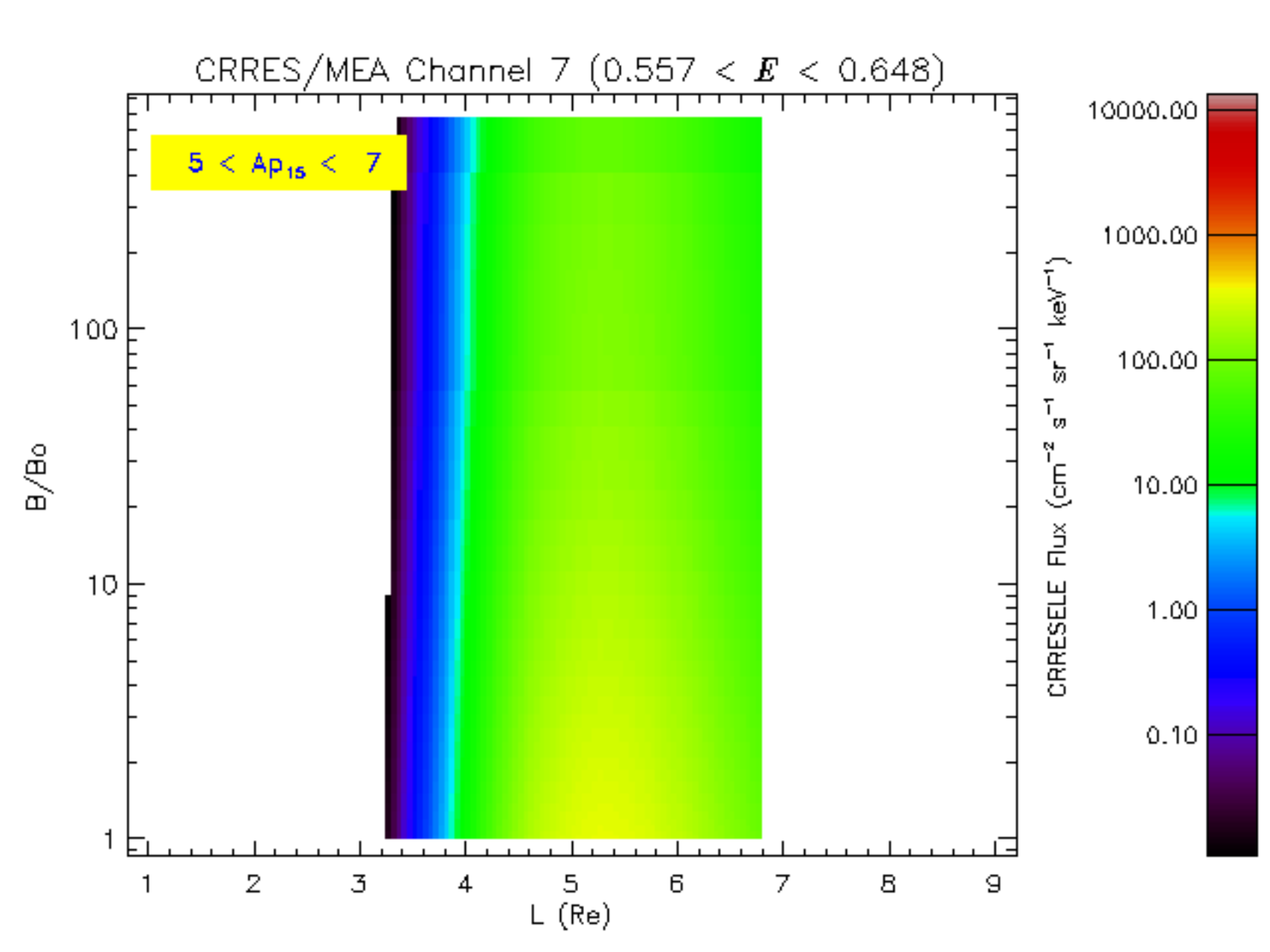

Orbit 0650
Pitch Angle (deg)
120
100
80
60
8.230×10^4
8.240×10^4
8.250×10^4
8.260×10^4
8.270×10^4
8.280×10^4
UT

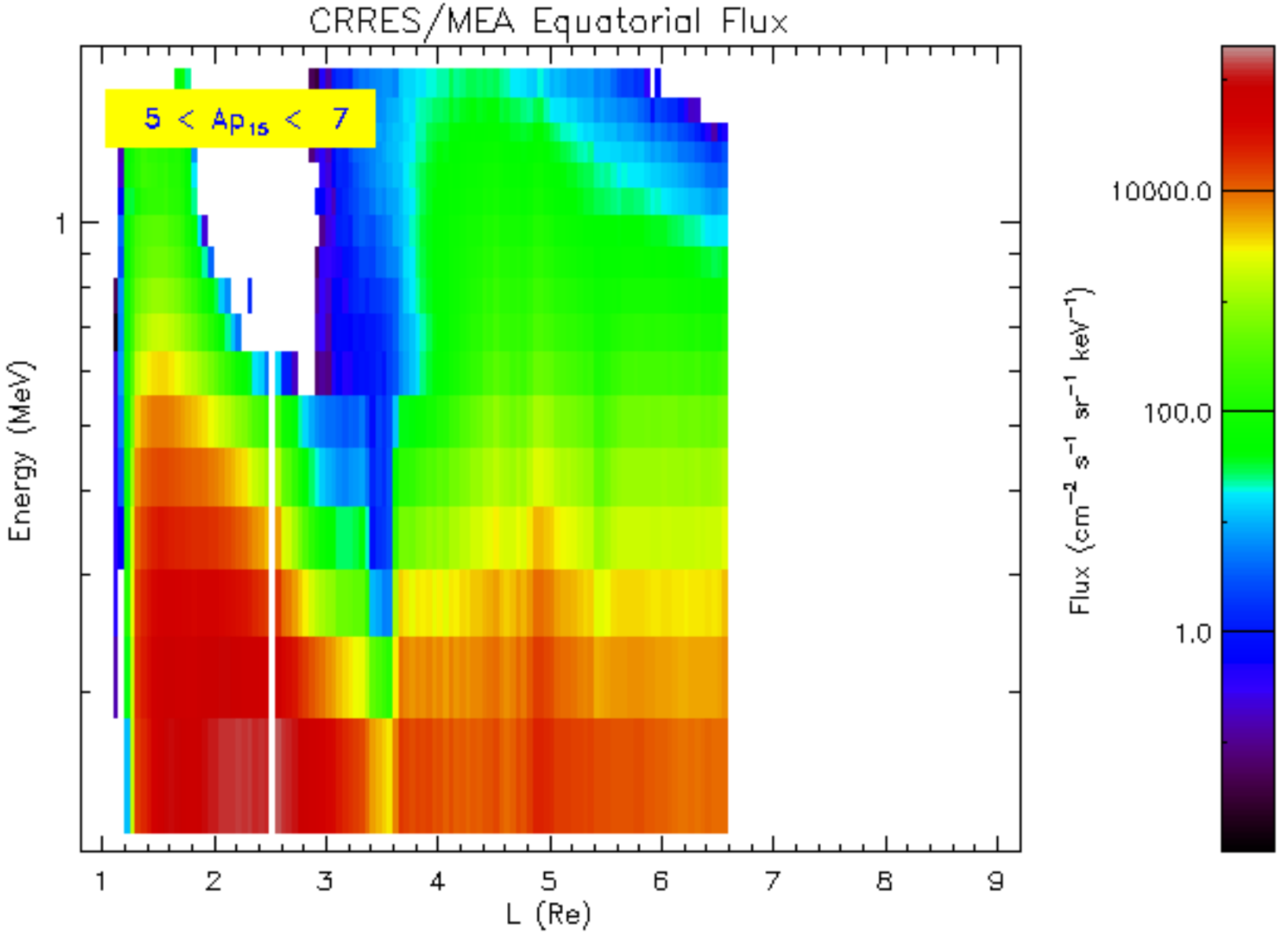

Orbit 650
180
150
120
90
60
30
0
Pitch Angle (deg)
5.036×10^4
5.038×10^4
5.040×10^4
5.042×10^4
5.044×10^4
5.046×10^4
5.048×10^4
Universal Time (sec)


Orbit 792
34.054
34.052
34.050
34.048
Pitch Angle (deg)
9.0x10^4
1.0x10^5
1.1x10^5
1.2x10^5
U.T.


Orbit 831
150
100
50
0
Pitch Angle (deg)
7.90x10^4
7.92x10^4
7.94x10^4
7.96x10^4
7.98x10^4
8.00x10^4
U.T.


CRRES/MEA Channel 7 (0.557 < E < 0.648)
5 < Ap15 < 7
B/Bo
100
10
1
1
2
3
4
5
6
7
8
9
L (Re)
Flux (cm-2 s-1 sr-1 keV-1)
10000.00
1000.00
100.00
10.00
1.00
0.10


CRRES/MEA Channel 7 (0.557 < E < 0.648)
5 < Ap15 < 7
B/Bo
100
10
1
1
2
3
4
5
6
7
8
9
L (Re)
CRRESELE Flux (cm-2 s-1 sr-1 keV-1)
10000.00
1000.00
100.00
10.00
1.00
0.10


CRRES/MEA Equatorial Flux
5 < Ap15 < 7
Energy (MeV)
1
L (Re)
1
2
3
4
5
6
7
8
9
Flux (cm-2 s-1 sr-1 keV-1)
10000.0
100.0
1.0